

2 Corporation). Light emission is measured with a luminometer (Berthold) for a
 period of 5 seconds. The data is reported in relative light units per second per
 4 *tibialis anterior*.

| Samples | RLU/s per 1 x 10 ⁶ cells |
|--|-------------------------------------|
| DC isolated from muscles injected with CMV-Luc in saline | 272±50 |
| DC isolated from muscles injected with pCMV-Luc formulated with PLURONIC F127/PLURONIC L61 @0.01 w/v | 3155±360 |

6 There will be various modifications, improvements, and applications of the
 disclosed invention that will be apparent to those of skill in the art, and the present
 8 application is intended to cover such embodiments. Although the present
 invention has been described in the context of certain preferred embodiments, it is
 10 intended that the full scope of these be measured by reference to the scope of the
 following claims.

12 The disclosures of various publications, patents and patent applications that
 are cited herein are incorporated by reference in their entireties.

14

WHAT IS CLAIMED IS:

- 16 1. Composition for inducing activation of dendritic cells comprising a
 polynucleotide, viral vector, or polynucleotide derivative thereof and at
 18 least one polyoxyethylene-polyoxypropylene block copolymer.
- 20 2. The composition of claim 1 further comprising a polycation.
- 22 3. The composition of claim 2 wherein the polycation is a polyamine polymer.

2 4. The composition of claim 2 wherein the polycation is an oligoamine or an
 oligoamine conjugate.

4 5. The composition of claim 1 wherein there is a mixture of block copolymers.

6 6. The composition of claim 5 wherein the block copolymers comprise a
 mixture wherein at least one block copolymer with oxyethylene content of
 50% or less, and at least one block copolymer with oxyethylene content of
 50% or more.

10 12 7. The composition of claim 5 6 wherein the block copolymers comprise a
 mixture a first block copolymer component having an oxyethylene content
 of 50% or less, and a second block copolymer component having an
 oxyethylene content of 50% or more wherein the weight ratio of said
 second block copolymer to said first block copolymer is at least 2:1.

14 18 8. The composition of claim 6 wherein the block copolymers comprise a
 mixture a first block copolymer component having an oxyethylene content
 of 50% or less, and a second block copolymer component having an
 oxyethylene content of 50% or more wherein the weight ratio of said
 second block copolymer to said first block copolymer is at least 5:1.

16 24 9. The composition of claim 5 wherein the copolymers comprise a mixture
 wherein at least one block copolymer has an oxyethylene content of 70%
 or more and at least one block copolymer has an oxyethylene content of
 50% or less.

20 28 10. The composition of claim 5 wherein N, according to the following
 expression, is from about 0.2 to about 9.0 and preferably from about 0.25
 to about 1.5:

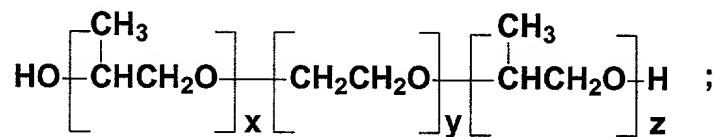
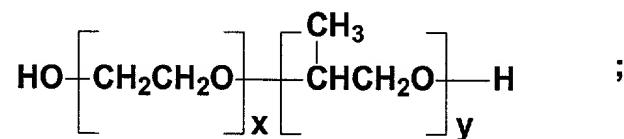
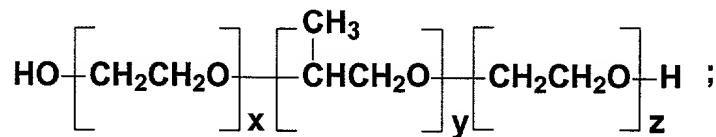
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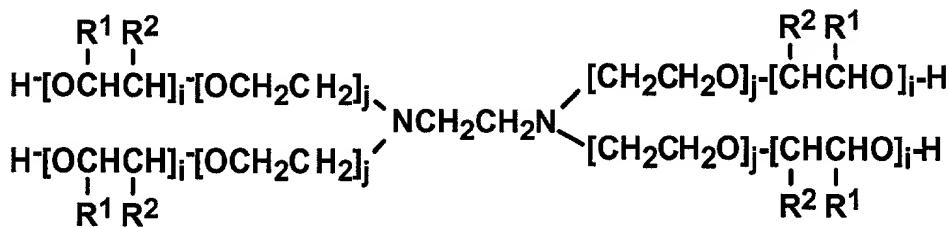
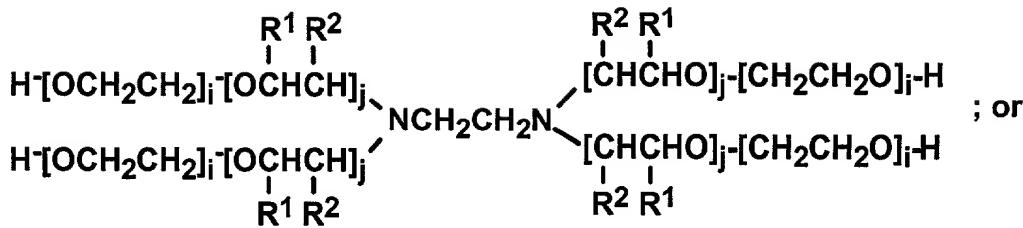
$$N = 1.32 \cdot \left[\frac{H_1 \cdot m_1}{(L_1) \cdot (m_1 + m_2)} + \frac{H_2 \cdot m_2}{(L_2) \cdot (m_1 + m_2)} \right]$$

in which H_1 and H_2 are the number of oxypropylene units in the first and second block copolymers, respectively; L_1 is the number of oxyethylene units in the first block copolymer; L_2 is the number of oxyethylene units in the second block copolymer; m_1 is the weight proportion in the first block-copolymer; and m_2 is the weight proportion in the second block copolymer.

11. The composition of claim 5 wherein the mixture comprises the block copolymer PLURONIC® F127.

12. The composition of claim 1, wherein at least one of the block copolymers has the formula:





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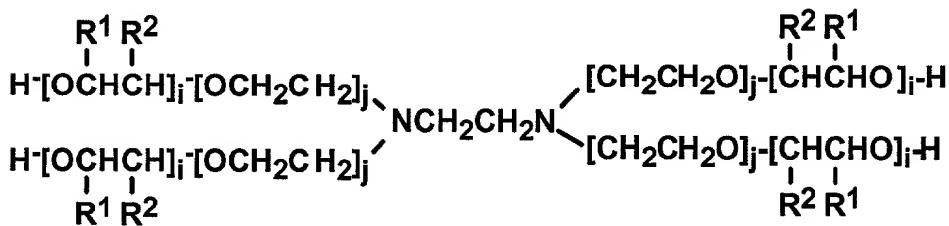
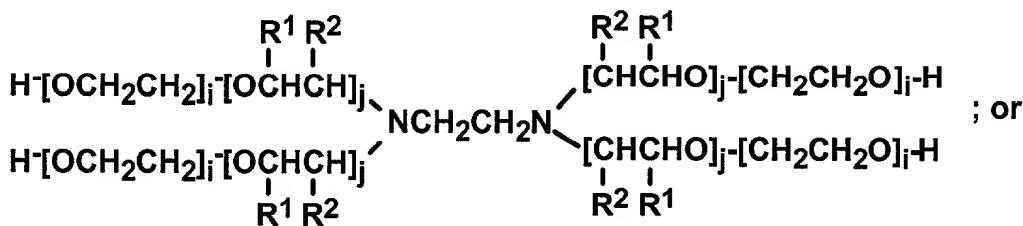
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in which x , y , z , i , and j have values from about 2 to about 400, and wherein for each R^1 , R^2 pair, one is hydrogen and the other is a methyl group.

8

13. The composition of claim 1 wherein at least one of the block copolymers has the formula:



2 in which x , y , z , i , and j have values from about 2 to about 400,
4 and for each R^1 , R^2 pair, one is hydrogen and the other is a methyl
group.

6 14. The composition of claim 1 wherein the block copolymer comprises at least
PLURONIC F127 and L61.

8

10 15. The composition of claim 14 wherein the ratio of PLURONIC F127:L61 is
8:1.

12

14 16. The composition of claim 14 wherein PLURONIC F127 is in the amount of
about 2%w/v and PLURONIC L61 is in the amount of about 0.025% w/v.

16

18 17. The composition of claim 1 wherein said block copolymer is present in
amounts insufficient for gel formation.

20

22 18. A composition for inducing the activation of dendritic cells comprising a
polynucleotide or derivative thereof and at least one polyoxyethylene-
polyoxypropylene block copolymer, wherein the block copolymer is present
at a concentration below about 15% wt/vol.

24

26 19. The composition of claim 18 wherein the block copolymer concentration is
below about 10%.

28

29 20. The composition of claim 18 wherein the block copolymer concentration is
below about 5%.

30

31 21. A composition for inducing the activation of dendritic cells comprising a
polynucleotide or derivative thereof and at least one polyoxyethylene-

2 polyoxypropylene block copolymer, wherein the composition forms a
molecular solution or colloidal dispersion.

4

6 22. The composition of claim 21 wherein the colloidal dispersion is a
suspension, emulsion, microemulsion, micelle, polymer complex, or other
type of molecular aggregate.

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10 23. The composition of claim 21 wherein the colloidal dispersion comprises
molecular species that are less than about 300 nm.

12 24. The composition of claim 21 wherein the colloidal dispersion comprises
molecular species that are less than about 100 nm.

14

16 25. The composition of claim 21 wherein the colloidal dispersion comprises
molecular species that are less than about 50 nm.

18

20 26. The composition of claim 1 wherein the polynucleotide is RNA, DNA,
plasmid DNA, virus, or viral vector.

22

24 27. The composition of claim 1 wherein the polynucleotide encodes a secreted
or non-secreted protein, vaccine or antigen.

26

28 28. The composition of claim 1 comprising a gene expressing a secreted or
non-secreted protein, vaccine or antigen and at least one gene expressing
an adjuvant molecule operable to activate antigen presenting cells and
induce immune response for enhanced antigen presentation.

30

29. A method of inducing activation of dendritic cells comprising administering
a composition comprising a polynucleotide or derivative thereof and at
least one polyoxyethylene-polyoxypropylene block copolymer.

2

30.The method of claim 30 wherein the block copolymers comprise at least
4 PLURONIC F127 and L61.

6

31.The method of claim 30 wherein the block copolymer is present in amounts
insufficient for gel formation.

8

32.A method of inducing activation of dendritic cells comprising administering a
10 composition comprising a polynucleotide or derivative thereof and at least
one polyoxyethylene-polyoxypropylene block copolymer, wherein the
12 composition forms a molecular solution or colloidal dispersion.

14

33.The method of claim 32 wherein the block copolymers are PLURONIC
F127 and L61.

16

34.A method of increasing the immune response of an animal comprising
18 administering the composition according to claim 1.

20

35.The method of claim 34 wherein the block copolymers comprise at least
PLURONIC F127 and L61.

22

36.The method of claim 34 wherein the composition is administered orally,
24 topically, rectally, vaginally, parenterally, intramuscularly, intradermally,
subcutaneously, intraperitoneally, or intravenously.

26

37.A method of increasing the immune response of an animal comprising
28 intramuscularly administering the composition according to claim 1.

30

38.The method of claim 37 wherein the block copolymers comprise at least
PLURONIC F127 and L61.

2 39. The method of claim 37 wherein said composition is administered to at
 least one of smooth, skeletal, and cardiac muscles.

4

5 40. A method of increasing the immune response of an animal comprising
 intradermally administering the composition according to claim 1.

8 41. A composition for inducing the activation of dendritic cells comprising at least
 one polyoxyethylene-polyoxypropylene block copolymer.

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11 42. The composition of claim 41 further comprising a polycation.

12

13 43. The composition of claim 42 wherein the polycation is a polyamine polymer.

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15 44. The composition of claim 41 wherein the polycation is an oligoamine or an
 16 oligoamine conjugate.

18

19 45. The composition of claim 41 wherein there is a mixture of block
 20 copolymers.

22

23 46. The composition of claim 45 wherein the block copolymers comprise a
 24 mixture wherein at least one block copolymer with oxyethylene content of
 50% or less, and at least one block copolymer with oxyethylene content of
 50% or more.

26

27 47. The composition of claim 46 wherein the ratio by weight of the block
 28 copolymer with oxyethylene content of 50% or less to the block copolymer
 with oxyethylene content of 50% or more is 1:2.

2 48. The composition of claim 46 wherein the ratio by weight of the block
4 copolymer with oxyethylene content of 50% or less to the block copolymer
with oxyethylene content of 50% or more is 1:5.

6 49. The composition of claim 45 wherein the copolymers comprise a mixture
8 wherein at least one block copolymer with oxyethylene content of 70% or
 more and at least one block copolymer with oxyethylene content of 50% or
 less.

10

12 50. The composition of claim 45 wherein N, according to the following
 expression, is from about 0.2 to about 9.0 and preferably from about 0.25
 to about 1.5:

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$$N = 1.32 \cdot \left[\frac{H_1 \cdot m_1}{(L_1) \cdot (m_1 + m_2)} + \frac{H_2 \cdot m_2}{(L_2) \cdot (m_1 + m_2)} \right]$$

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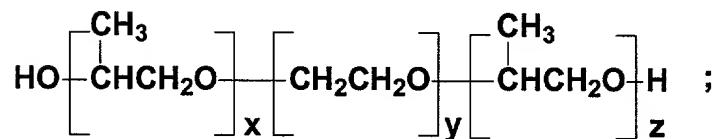
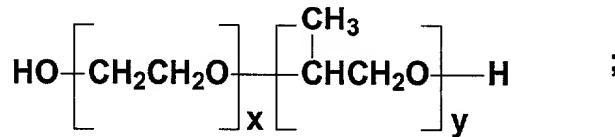
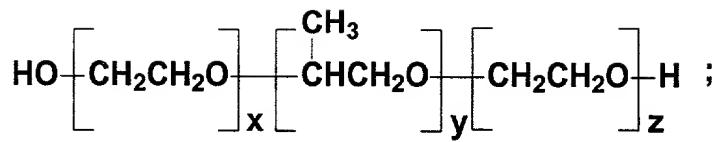
18 in which H_1 and H_2 are the number of oxypropylene units in the first and
 second block copolymers, respectively; L_1 is the number of oxyethylene
 units in the first block copolymer; L_2 is the number of oxyethylene units in
 the second block copolymer; m_1 is the weight proportion in the first block-
 copolymer; and m_2 is the weight proportion in the second block copolymer.

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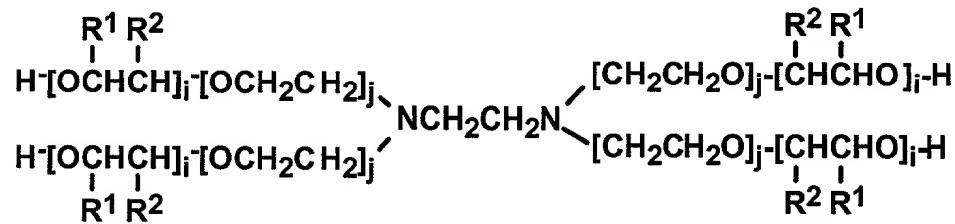
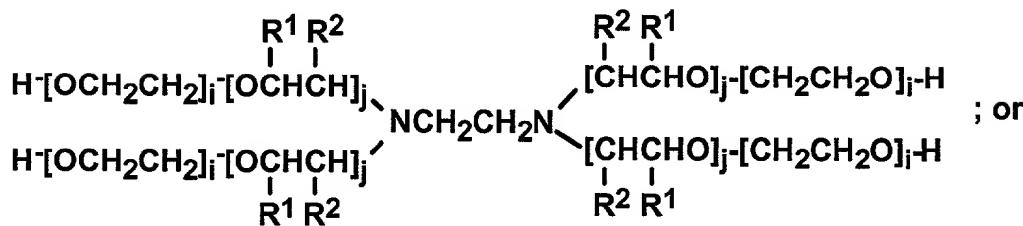
22 51. The composition of claim 45 wherein the mixture comprises the block
 copolymer PLURONIC® F127.

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52. The composition of claim 41, wherein at least one of the block copolymers
 has the formula:



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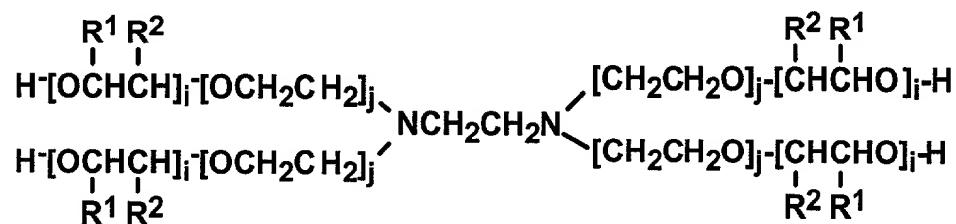
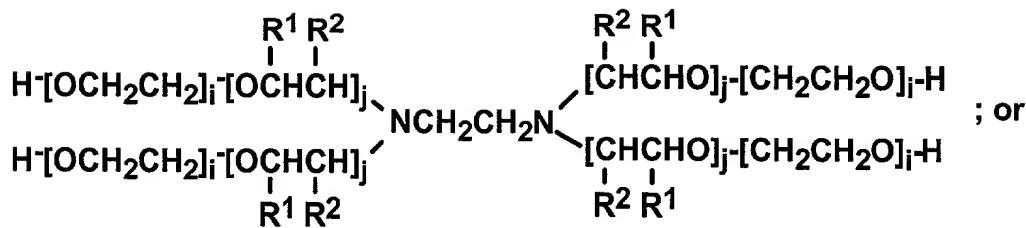


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in which x , y , z , i , and j have values from about 2 to about 400, and wherein for each R^1 , R^2 pair, one is hydrogen and the other is a methyl group.

6

8 53. The composition of claim 41 wherein at least one of the block copolymers has the formula:



2

in which x , y , z , i , and j have values from about 2 to about 400, and for each R^1 , R^2 pair, one is hydrogen and the other is a methyl group.

6 54. The composition of claim 41 wherein the block copolymer comprises at least PLURONIC F127 and L61.

8

10 55. The composition of claim 40 wherein the block copolymer is present in amounts insufficient for gel formation.

12 56. A composition for inducing the activation of dendritic cells comprising at least one polyoxyethylene-polyoxypropylene block copolymer, wherein the 14 composition forms a molecular solution or colloidal dispersion.

16 57. The composition of claim 56 wherein the colloidal dispersion is a suspension, emulsion, microemulsion, micelle, polymer complex, or other 18 type of molecular aggregate.

2 58. The composition of claim 56 wherein the colloidal dispersion comprises
molecular species that are less than about 300 nm.

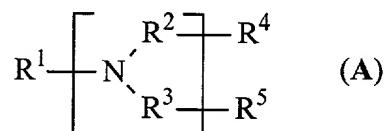
4 59. The composition of claim 56 wherein the colloidal dispersion comprises
6 molecular species that are less than about 100 nm.

8 60. The composition of claim 56 wherein the colloidal dispersion comprises
molecular species that are less than about 50 nm.

10 61. A composition for inducing activation of dendritic cells comprising a
12 polynucleotide or derivative thereof and at least one polycationic polymer
14 having a plurality of cationic repeating units.

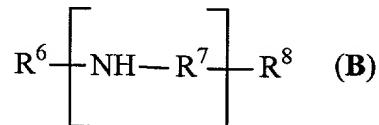
16 62. A polynucleotide composition according to Claim 61 wherein said
18 polycationic polymer is a cationic homopolymer, copolymer or block
20 copolymer comprising one or more of the following fragments:

- (a) at least one aminoalkylene monomer selected from a group
consisting of:
- (i) a tertiary amine monomer of the formula



24 and,

- (ii) a secondary amine monomer of the formula



2

in which:

each of R¹, R⁴, R⁵, R⁶ and R⁸ taken independently of each other is hydrogen, alkyl of 2 to 8 carbon atoms, another A monomer, or another B monomer;

each of R², R³ and R⁷, taken independently of each other, is a straight or branched alkanediyl of the formula -(C_zH_{2z})- wherein z has a value of from 2 to 8;

10 (b) cationic amino acids;

12 (c) (-OPO(NH-R⁹-NR¹⁰R¹¹R¹²)O-R⁸-) in which R⁹ is a straight chain aliphatic group of from 1-12 carbon atoms and R⁸ is -(CH₂)_n-CH(R¹³)- where n is an integer from 0 to 5, R¹⁰, R¹¹ and R¹² are independently hydrogen or alkyl of 1 to 4 carbon atoms and R¹³ is a hydrogen, cycloalkyl having 3-8 carbon atoms. or alkyl of 1-2 carbon atoms; and

16 (d) vinylpyridine or a derivative thereof.

18 63. A composition according to claim 62 comprising a polynucleotide and a polymer of a plurality of segments, wherein the polymers comprise at least one polycationic segment which is cationic homopolymer, copolymer, or block copolymer, or quaternary salt thereof; and either,

22 (a) at least one straight or branched chain polyether segment of from 5 to about 400 monomer units which polyether segment is:

24 (i) a homopolymer of at least one alkyleneoxy monomer -OC_nH_{2n}- in which n has a value from 2 to 3; or,

26 (ii) a copolymer or block copolymer of said first alkyleneoxy monomer and a second different alkyleneoxy monomer -OC_mH_{2m}-, in which n has a value from 2 to 3 and m has a value from 2 to 4 or,

30 (b) a homopolymer or copolymer of at least one monomer from a group consisting of acrylamide, glycerol, vinyl alcohol, vinyl pyrrolidine,

2 vinylpyridine-N-oxide, oxazoline, morpholine acrylamide, and derivatives
thereof.

4

6 64. A composition according to claim 63 wherein said first alkyleneoxy
monomer is ethyleneoxy (-OCH₂CH₂-) and said second alkyleneoxy
monomer is propyleneoxy (-OCH(CH₃)CH₂-).

8

10 65. A composition of claim 63 wherein the polycationic polymer, at
physiological pH, comprise at least six cationic groups.

12

14 66. A polynucleotide composition according to claim 63 wherein the
polycationic polymer, at physiological pH, contain a plurality of cationic
groups separated by about 3Å to about 12Å.

16

18 67. A polynucleotide composition according to claim 63 wherein each of
said polyether segments has from about 5 to about 80 monomeric units
and said polycationic segment is a homopolymer, copolymer or block
copolymer of from 2 to about 180 of the same or different monomeric
units of the formula -NH-R^o- in which R_o is a straight chain aliphatic
group of 2 to 6 carbon atoms which may be optionally substituted.

20

22 68. A composition according to claim 69 wherein the polycationic polymer is
covalently linked with at least one nonionic polymer segment.

24

26 69. A method of inducing activation of dendritic cells comprising administering
a composition comprising a polynucleotide or derivative thereof and at
least one polyoxyethylene-polyoxypropylene block copolymer.

28

30 70. A method of inducing the activation of dendritic cells comprising
administering a composition comprising at least one polyoxyethylene-

2 polyoxypropylene block copolymer, wherein the block copolymer is present
in amounts insufficient for gel formation.

4
6 71. The method of claim 70 wherein the block copolymers comprise at least
PLURONIC F127 and L61.

8 72. A method of inducing activation of dendritic cells comprising administering
a composition comprising at least one polyoxyethylene-polyoxypropylene
10 block copolymer, wherein the composition forms a molecular solution or
colloidal dispersion.

12
14 73. The method of claim 72 wherein the block copolymers are PLURONIC
F127 and L61.

16 74. A method of increasing the immune response of an animal comprising
administering the composition according to claim 72.

18
20 75. The method of claim 72 wherein the composition is administered orally,
topically, rectally, vaginally, parenterally, intramuscularly, intradermally,
subcutaneously, intraperitoneally, or intravenously.

22
24 76. The method of claim 72 wherein said composition is administered to at
least one of smooth, skeletal, and cardiac muscles.

26
28 77. A method of improving the immune response of an animal comprising
intradermally administering the composition according to claim 34.